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System Analysis and Design in Schools

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SYSTEM ANALYSIS AND DESIGN IN SCHOOLS

by

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PREFACE

Technological and methodological advances applicable to education are arriving
with increasing rapidity. The traditional school, populated by a mass of
students subdivided into classes composed of 30-35 students, with a teacher
presiding over each class and with a principal and a small staff to coordinate
and administer the aggregate, has failed to demonstrate good ability to adjust
readily to innovations.

The purpose of this document is to describe the role which the Administrative
and Support Systems group of SDC's Education Research and Development project
may play in analyzing and designing systems which will adapt more readily to
new technology and methodology.

In this paper the assumption is made that instruction planning and design will
be done by some other team such as the Instruction Systems group at SDC.

INTRODUCTION

Advances are taking place with increasing tempo in technology and methodology pertinent to education. Since World War II, such innovations as educational television, language laboratories, team teaching, and programmed teaching have opened the way to alternative instruction approaches. Unfortunately, the traditional school cannot be readily adjusted to accommodate these innovations. The typical public school, its students divided into classes all the same size, lock-stepping their way through the curriculum, has maintained a structure in which only minor modifications are possible. Furthermore, even minor changes in an ongoing program often face major obstacles which prevent their implementation.

Problems associated with innovation are not unique to education. Large industrial and military organizations have faced similar difficulties (Hopkins, 1960; Heyne, 1961; Jaffe, 1962). In such fields, studies attempting to resolve implementation obstacles and related organizational problems have resulted in development of extremely effective techniques for analyzing systems and for introducing changes to these systems. These recently developed techniques appear to have application to a wide range of systems, including schools (Kershaw and McKean, 1959; Willis, 1962).

The purpose of this paper is to discuss application of system analysis and design procedures in developing new school organizational patterns. These procedures may be used in an ongoing school system to facilitate limited modifications or they may be applied to a new school to permit drastic changes from the traditional school pattern.

Through the innovations that have become available to education in recent years, a single teacher in a central studio can give a lecture or demonstration visible and audible to hundreds of students in numerous classrooms in each of many schools; or the teacher in a given classroom may work with one student while others are proceeding at their own pace with programmed materials; or teaching teams can be formed so that while one teacher is lecturing to a large group of students, others can be preparing for future lessons.

Bolstered by such innovations, some school administrators have been experimenting with the structure of schools. The Trump Plan, with its emphasis on team teach-ing, on multisized groupings, and on use of clerks and teacher aides, has been instituted in a number of schools. Interschool educational television is also being used effectively by a limited number of districts. One of the more pro-mising directions being attempted is the experimentation which some schools are conducting to produce greater individualization of instruction.

Experimenting with the organization of a school presents many difficulties and can be expensive; hence, even those districts in which plans are given long and careful consideration face knotty problems. Description of three schools experimenting with their organization may serve to illustrate types of inno-vations and also some of the problems that are developing.

School 1

An eastern high school which recently received national publicity is
permitting students to progress at different rates through the curriculum.
This has been accomplished by describing each course as a series of study
units; dividing students into homogeneous classes and then further sub-
dividing each class homogeneously, much as an elementary school teacher
does; helping each subgroup to move at its own rate through the units of
study in a course; and defining completion of the course as satisfactory
completion of all the units and passing of a final examination. Thus,
one student group may complete a course in six months while another requires
fifteen months. A student who moves at a rate different from the rest of
his subgroup is placed in a more appropriate group.

Student progress is reported in terms of (a) extent of progress and
(b) quality of work. Thus, each parent is informed how far his child has
progressed in each subject and also how thoroughly he has mastered the
work covered.

School 2

The personnel of a junior high school in southern Los Angeles County are
attempting to provide individualized instruction at the ninth-grade level
in a manner quite different from that of School 1. Children all spend the
same amount of calendar time on a course, but the daily time units may vary,
thus providing opportunity for such elective activities as special science
projects, typing, or remedial or speed reading. To effect this plan, the
ninth grade is rescheduled each day in the following manner:
a. The school day has been divided into fourteen 20-minute time modules
    with five minutes between modules.
b. Every day each teacher submits a time request for four days later,
    indicating the number of modules needed for each class. (The day the
    teacher turns in the request will be referred to here as Day 1 and
    all subsequent days will be numbered from there.)
c. On Day 1, team leaders, using the teacher time requests, assemble a
    schedule unique to Day 4. This schedule is then reproduced.
d. During the first time module of Day 2, the students meet in groups of
    20 with a teacher-counselor and each student prepares his personal
    schedule for Day 4 in quadruplicate, using pressure-sensitive paper.
e. During Days 2 and 3, the teacher-counselor checks the schedule for
    every student to determine whether he is properly registered for Day 4.
f. On Day 4, the student carries his schedule with him so that each
    teacher may stamp it to indicate attendance.
g. The stamped schedules are collected centrally and checked to ensure
    that each student has been present for each selected activity.

School 3

At the present time, a strikingly different plan is being prepared for a high school in eastern Los Angeles County. While this school will not be operational until 1964, education and building plans are both being advanced rapidly. The Continuous Progress Plan, described by Read (1963), forms the basis for the educational plan being developed. This plan is designed to permit students to move at their own rate through the curriculum. To achieve this goal, instruction is oriented around individuals and small groups. The physical plant will have a large central room with individual study stations (carrels) where it is estimated each student will spend from 50 to 70 percent of his time.

While instructional procedures will vary from course to course, a typical academic course will proceed somewhat as follows. Those students ready to begin the course at a particular time will go to a small lecture room where a teacher will introduce the course, outlining content, procedures, etc., answering questions and leading discussion. At the conclusion of this introduction, appropriate materials will be issued to each student and he will proceed to individual study in his carrel using programmed materials, library resources, etc. As a student completes each instructional unit in a course, his work will be evaluated and, if it is judged satisfactory, the student will have the next unit introduced to him. In addition to the individual and lecture-discussion work of the course, small groups of students will also complete appropriate group projects and will participate in seminars and other group activities.

Student registration will be an individual matter and may occur at any time during the year. Registration will take place most frequently at the time of completion of a course, but it may also occur at other times. Different students may be registered for differing numbers of courses and the number of courses for any student may vary rather widely over a period of time.

Each of the three schools just described is attempting to make better provision for individual differences. The solutions developed differ greatly in some respects but are parallel in others. Schools 1 and 3 provide for a difference in course calendar time, while School 2 requires that students spend the same calendar time in a course but permits the daily period to vary. Schools 1 and 2 retain traditional class groupings, but School 3 considers the individual to be the unit. Traditional instructional materials and media are used in Schools 1 and 2, but School 3 will employ programmed instructional materials, film strips, and other innovations.

The three schools described share some interesting and perplexing problems. Some of the more pronounced problems are:
      (1) The role of the teacher in each of these schools is different from that of the teacher in a traditional school. What is the nature of

this new role and how should the training of these teachers differ
from that currently being given?

(2) Scheduling, typically a relatively simple matter occurring only twice
     a year, becomes much more complex. How can this problem be solved
     so that a minimum of teacher-administrator time is required?

(3) Student progress, once controlled by the student's schedule and by
     his teachers, now becomes an open problem. Especially in School 3,
     how can there be assurance that students are progressing at rates
     and in directions commensurate with their abilities and interests?

The schools described, the parallels drawn, and the problems raised all are
designed to contribute to our understanding of the situation faced by the
community that wants to introduce major innovations in its schools. Even
presuming that patrons and school personnel are agreed on goals and on the
general nature of the innovations, the tremendous task remains of adapting
the innovations to the ongoing system or designing a new system to accommodate
the innovations.

Definitions

In this paper "school system" is used to refer either to a single school or to
a school district or other multiple-school organization, to which the term
"school system" is usually applied. This is done because analytic procedures
used for a single school are similar to those applicable to a district and
because in many respects a single school may legitimately be considered to be
a system.

While we believe instruction to be the raison d'être for schools, we also
believe that supporting systems must be so designed as to permit some modifi-
cation in the instructional program without forcing a completely new design
in the administrative and supporting systems. Thus, "school system" refers
to the administrative structure and various supporting subsystems such as the
counseling service or the library, rather than to instruction per se. We are
interested in designing systems for schools in such a manner that diverse
instructional programs can be accommodated.

OBJECTIVES

In analyzing and designing or redesigning systems for schools, the following
objectives should be considered.

1. Define new roles for school personnel.

    In a traditional school, the personnel have relatively well-defined
    roles. Many advocates of educational innovations state that these
    innovations will "free the teacher for other activities." Critics
    suggest that these new roles have not been adequately defined. A

prime objective of the analysis of a school system should be to define roles essential for successful operation of that system.

2. Provide information on characteristics of the newly developed school system.

   Critics of educational television and programmed learning have expressed fear that, if these techniques are applied extensively in a school, an unhealthful reduction in the amount and type of teacher-pupil and pupil-pupil interaction will result. A major objective of a system analysis of a school should be to investigate the extent to which this and other reservations concerning innovations are justified and to explore ways of adjusting for any problems which become apparent.

3. Describe applications of data-processing equipment in the new school.

   As flexibility is increased in school programs, student control problems increase since the teacher no longer will have an exact schedule to which each student must adhere. Particularly in a flexible type of school, recent data-processing equipment will find application. An important objective of an analysis should be to determine and describe ways in which such equipment might be used.

4. Provide information on amount and arrangement of space in the school.

   Traditional high schools are typically built with a number of similar classrooms to house students in groups that vary little in size, a few administrative offices, a gymnasium, a small library, and a few additional rooms of varying sizes and purposes. A school organized differently might require the same total floor space but with a different arrangement. Semiprivate stations for individual study, rooms for smaller seminar groups, and large lecture rooms are all likely possibilities. An objective of a system analysis should be to provide information on amounts and probable uses and arrangements of floor space for the school being analyzed.

5. Provide estimates of characteristics of graduating students.

   At the present time, most students are annually promoted from grade to grade and almost all complete high school in the age range 17-19. These graduating students have diverse achievements in the various curricular areas, but this diversity is rather well known. If major changes are made in schools, for example, permitting students to proceed at their self-determined rates, the characteristics of the graduating students may change radically. Age may become much more variable. On the other hand, if students are permitted to spend sufficient time to master each concept in turn, a marked reduction in range of achievement among graduates is possible. This is a fifth objective of a system analysis, to provide information on possible changes in characteristics of graduating students.

NEW SYSTEMS FOR SCHOOLS

The remainder of this paper is primarily concerned with describing procedures which we believe appropriate to observe in analyzing and designing systems for schools. In general, the procedures described parallel those appropriate for use in analyzing any complex system. No particularly unique or original ideas are presented; rather, routine system development procedures are applied to schools.

The steps described in this paper do not include a feasibility study, but the assumption is made that such a study would precede the described steps. The decision to conduct a system analysis is made only if a feasibility study demonstrates that such an analysis may achieve worthwhile goals.

As a minimum, then, the decision to analyze a system assumes that (a) the system is in need of being analyzed, (b) recommendations can be developed which would be feasible and which, if implemented, would result in improvement to the system, and (c) persons responsible for operation of the system will use the results of the analysis.

The analysis of the system of a school is described in this paper as consisting of nine steps.
1. Prepare a statement of educational goals.
2. Develop a descriptive model of the system.
3. Simulate the model on the computer.
4. Determine whether the model is ready for documentation.
5. If the model is not ready for documentation, make appropriate changes.
6. When simulation proves it satisfactory, document the model.
7. Test the system requirements against reality.
8. Determine whether the system is ready for implementation.
9. When the system is ready for implementation, conduct field tests.

These nine steps are depicted graphically in figure 1 and are discussed in detail below.

1. The first step in developing a system for a school is to prepare an operational statement of goals. The nature of the goals and the level of specificity with which they must be stated are determined by the expected outcomes of the analysis. If an instructional program is to be prepared, the educational goals must be stated in terms of specific behavior desired, e.g., a goal for a section of reading instruction might be that each child must recognize eight out of ten words on the list with 90 percent accuracy. On the other hand, if the project is to analyze or design the information-processing system in which the instructional program is embedded, educational goals may be stated much more generically, e.g., an educational goal might be that graduating high school students have educational status commensurate with their abilities, interests, and motivation. (The implication of this goal is that the instructional and related programs would be so designed

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┌──────────────┐     ┌──────────────┐     ┌──────────────┐          ◇ Is
│ Prepare      │     │ Develop      │     │ Simulate     │            model
│ statement of │ --> │ descriptive  │     │ model on     │ -->      ready for       Yes
│ educational  │     │ model of     │     │ computer.    │          documentation?
│ goals.    1  │     │ system.   2  │     │           3  │               4
└──────────────┘     └──────────────┘     └──────────────┘               No

                                          ┌──────────────┐
                                          │ Effect design│
                                          │ changes in   │
                                          │ model.       │
                                          │           5  │
                                          └──────────────┘

┌──────────────┐     ┌──────────────┐          ◇ Is
│ Document     │     │ Test system  │            system
│ requirements │ --> │ requirements │ -->      ready for          Yes  ┌────────────────┐
│ of system.   │     │ against      │          implementation?         │ Conduct        │
│           6  │     │ reality.  7  │               8                  │ field          │
└──────────────┘     └──────────────┘               No                 │ implementation.│
                                                                        └────────────────┘
```
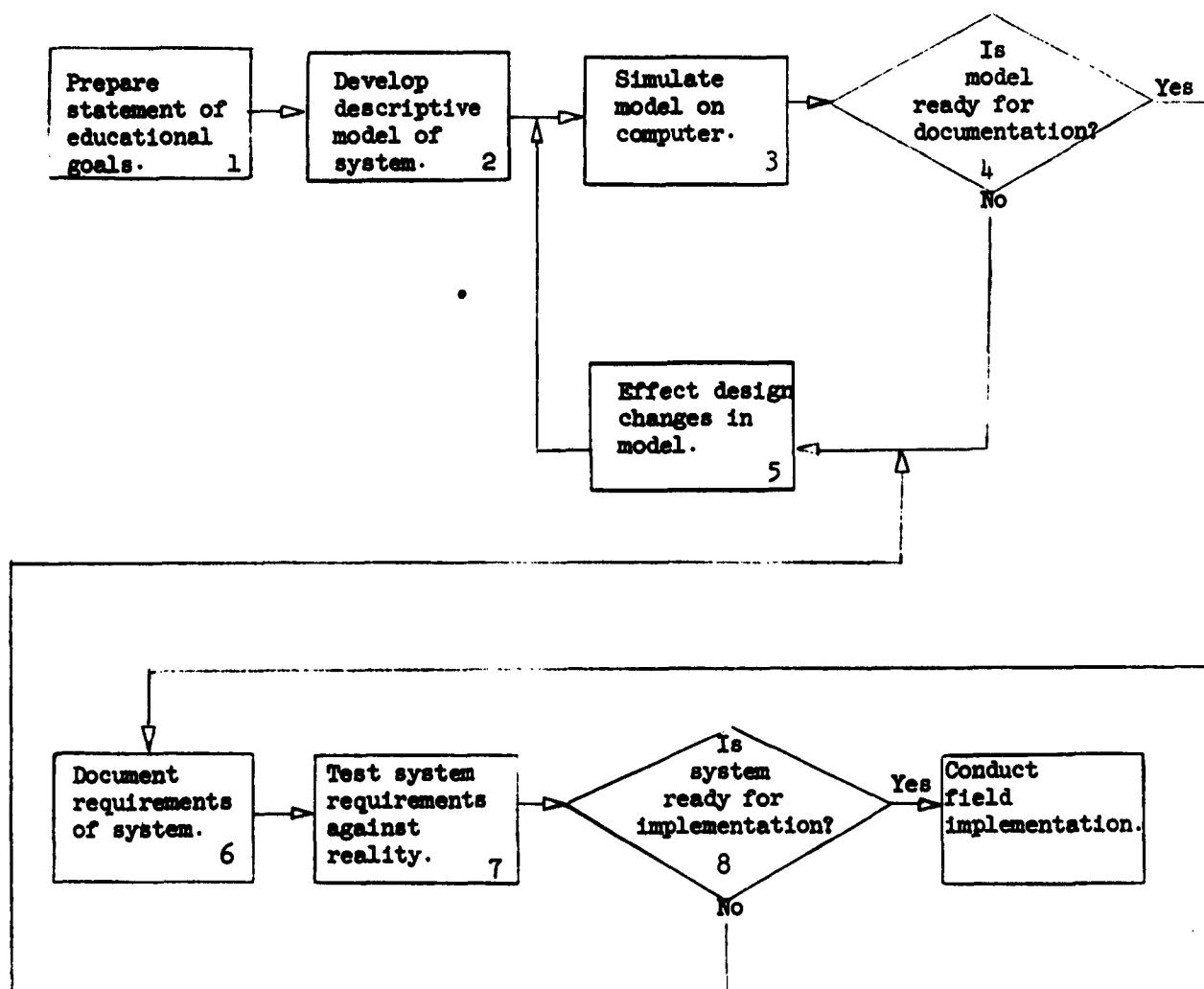
Figure 1.   Steps in Designing New Systems for Schools

as to permit students to progress at their own rates.) Goals stated in
this latter fashion are almost totally useless for detailed planning of an
instructional program, but they do give general guidance for a system
analysis.

Regardless of whether the objective is to plan an instructional program
or to analyze the embedding information-processing system, priorities
must be attached to the educational goals. Only when the priorities are
established can the system designer differentiate between the most signifi-
cant goals and those added as an afterthought or as an appeasement of some
individual or group having special interest in a particular goal.

An example of a goal for the information-processing system for School 3,
described earlier, is that, with a maximum time delay of one hour, the
system must be able to provide a list and an abbreviated description of
the characteristics of the students who will be ready to begin a given
unit of a given course at a given time. As in the case with educational
goals, priorities must also be established for these system goals as a
guide to the system analyst.

2. The second major step in conducting a system analysis of an educational
    institution is to develop a descriptive model of the system. The system
    thus described must be so designed to permit achieving the stated goals.
    Thus, the initial description must be ideal-oriented and must be divorced
    from restrictions imposed by reality, as reality is viewed by the typical
    practitioner. This "escape from reality" is necessary because when re-
    strictions to thinking are applied early, real creativity of solution may
    be prohibited.

    The removal of external restrictions does not imply that there is no need
    for internal consistency of the model. The reverse is true. As normal
    restrictions to planning are removed, thus freeing the designer to think
    creatively, the danger of planning a system in which the component parts
    are not compatible is materially increased. To insure internal consistency
    and to permit close scrutiny of the model, logical flow charts must be
    constructed. These flow charts should show channels of communication and
    should depict the decision-making apparatus.

    Logical flow charts should be constructed of the different phases of the
    system, showing operations, movement, decisions, and interactions.

    Three different types of flow charts are viewed as being important. The
    first gives the overall structure of the school and shows the various
    subsystems and their interactions. The second gives specifics of every
    subsystem and demonstrates in fine-grained detail the operation of each.
    The third illustrates the way in which the system actually handles prob-
    lems. For this purpose, the system is presented with several different
    specific problems and the manner in which it deals with each is then
    described.

Figure 2 depicts a flow chart describing a student's progress through a typical course in School 3, as described earlier. It is intended to represent progress through an academic course such as history or English with the full recognition that there will be many differences between courses even as similar as these. (The flow chart shown as figure 2 deals only with gross functions. Each activity represented would require one or more charts to give a full description. Appendix A is a flow chart giving a more complete explication of an activity.) The following discusses figure 2 in more detail.

Box 1: Box 1 represents the registration process.

Boxes 2 and 3: Each new course will be introduced in a fairly formal session. An overview of the course with its purposes and an outline for achieving these purposes will be presented. The formal presentation will be followed by a less structured discussion period so that students may pursue questions that arise. Course materials will also be issued during the introductory session. This process is shown in box 2.

Each course will be broken down into a series of concepts. As a student becomes ready to begin work on a new concept, he will go with other students to a small seminar-type room for an initial presentation by the teacher. Following this presentation and the ensuing discussion, each student will go to his own carrel to work on the materials provided. Box 3 depicts the process just described.

The content of box 3 presumes that the person scheduling initial presentation of concepts will know which students will likely be ready at a given time to have a new unit presented. He will also need to know availability of rooms and teachers, and he must then do the appropriate scheduling and inform those concerned of his actions.

Boxes 4 through 10: Boxes 4 through 10 describe the work of the student in his carrel. Starting with box 4, the student is depicted as studying alone, using the facilities of the library and laboratory in addition to the materials issued, until he feels he needs help (box 5), or until some external agent decides he needs help (box 6), or until he completes the concept and is ready to be evaluated (box 8). When the student is evaluated and judged to be progressing satisfactorily (boxes 8 and 9), he moves out of this subroutine. If the student's work is judged to be unsatisfactory, supplementary materials are issued (box 10), and the student returns to work in his carrel.

Many of the problems of organization and information processing in a flexible high school are included in the subroutine indicated in boxes 4 through 10. Scheduling the library, laboratory, and film facilities of a flexible school will be much more complex than in a traditional school. Anticipating the extent of academic aid required by students in their carrels will also be difficult. Perhaps the hardest problem of all will be tracking and evaluating the performance of individual students and then providing remedial help of whatever nature is needed.

Start

Registration and assignment to classes. 1

Course introduced. Materials issued. 2

Concept introduced. 3

Student studies in carrel. Uses library and laboratory facilities. Sees films. 4

Does student complete concept without difficulty? 5

Has student done work of satisfactory quality at expected rate? 6

Student is evaluated. 8

Is student's work satisfactory? 9

Receives appropriate help from teacher, aide or counselor. 7

Supplementary material issued. 10

Proceed to step 24. 12

Was this a concept other than last one in course? 11

Consider assigning student to group activity. Ask such questions as "Has student met prerequisites?" 13

Should student be assigned to group activity? 14

Group project introduced. 15

Student works on project in seminar room with other Students. Students use library. 16

Do students complete project without difficulty? 17

Do students do work of satisfactory quality at expected rate? 18

Is completed project satisfactory? 20

Students receive appropriate help. 19

Each student is evaluated. 21

Is Student's work satisfactory? 22

Has student completed last project in course? 24

Has student taken all courses for his graduation? 28

Halt

Supplementary material issued. Student studies in carrel. 23

Is student ready for next group project? 25

Return to step fifteen. 27
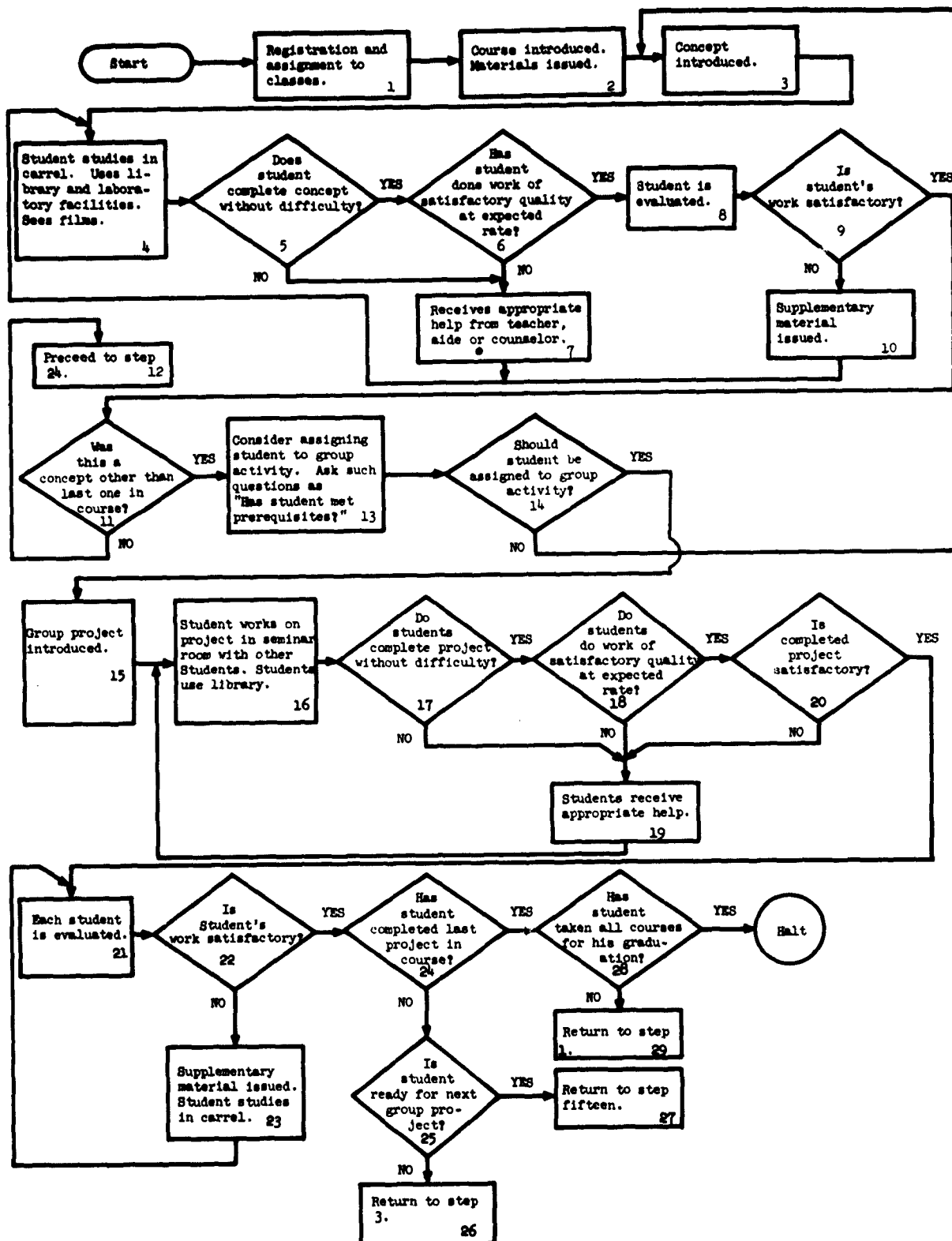
Return to step 1. 29

Return to step 3. 26

Figure 2. Flow Chart of Individual-Student Program

Boxes 11 and 12: Boxes 11 and 12 are related to boxes 24 and 28 and will be discussed later.

Boxes 13 and 14: While much of learning is individual in nature, there is also a great deal that can be learned only in a group, e.g., group-interaction techniques and certain speech skills. Furthermore, much of the social development that takes place during the secondary-school years is probably fostered and facilitated by the kinds of group experiences that are used by schools. For such reasons as these, provision must be made in a flexible school for various types of group work. Boxes 13 and 14 provide for starting a student in group activity. Box 13 suggests that various questions may be asked prior to making a decision assigning a student to a group. For example, he must have met the prerequisites for the group activity; ordinarily he will not be the only one of his sex in the group; normally a student will not be put in a given group if his intelligence quotient differs radically from the others in the group.

Because of the complexities involved, constituting these groups will probably require the help of data-processing equipment.

Boxes 15 through 24: Boxes 16 through 23 form a subroutine describing a group activity. As is indicated, the usual procedure will probably be for the group to gather at a predetermined time in a seminar room, with a teacher introducing their project to them (box 15). After some discussion in the presence of the teacher, the group will proceed to work without teacher direction, using available facilities (box 16), until they want help (box 17), or until there is some behavioral indication that they need help (box 18), or until they complete the project (box 20). (Receipt of help is shown by box 19.) At the satisfactory conclusion of a project, each student will be evaluated on the content of the unit (box 21). If he fails (box 22), he will receive supplementary materials to study on his own (box 23) until he is judged to be doing satisfactory work (box 22).

As in the individual subroutine, in lieu of the high degree of personal control exercised by the teacher in the traditional school, control must be maintained through frequent updating of progress of the group with an interpretation of the adequacy of the progress.

Box 25: Box 25 inquires whether the student is ready for the next group activity. If the answer is positive, he is returned to box 15; if negative, to box 3.

Boxes 11, 12, 24, and 28: Activities in boxes 11, 12, 24, and 28 move the student from one course to another and also indicate his arriving at the end of his program of study.

The flow charts described above will permit the system designer to determine what information is needed, when, and by whom; where the information is

generated; and who makes decisions and to whom these decisions must be transmitted. The flow charts will also enable the designer to locate and correct internal problems of the model.

3. The complete, logical flow charting of a school and an analysis of these charts should serve as the prelude to a more complete study via computer simulation (Harman, 1961). Computer simulation will enable manipulation of the "school" and will give more information about it, thus eventually saving a great deal of time and money.

    To permit study of the school through simulation, a flexible model should be constructed (Egbert, 1962). This is facilitated through use of procedures developed at System Development Corporation (Bennett et al., 1962; Lackner, 1962; Rome and Rome, 1962). This model should involve computer representation of students, teachers and other school personnel, curriculum, space, equipment, etc.

    This phase of the analysis will involve determining important variables in the system, preparing specifications for a computer model, constructing the model, checking out the model, obtaining data from its operation, and analyzing and evaluating the data.

4. When the data obtained from operation of the computer model have been analyzed, a decision must be made as to whether, from an internal standpoint, the model requires revision or whether it is ready for documentation.

5. If the system designer decides the model is not ready for documentation and testing, he makes the needed modifications prior to further simulation.

6. When the simulation study indicates that the model is internally consistent and is constructed of compatible processes and subsystems, the model is ready for documentation. Before this step can be taken, new terms and concepts must be carefully defined. As stated in step two, the designer must initially have an ideal orientation, unfettered by restrictions of reality. Not only should he not concern himself with cost and availability of personnel and equipment, he should also not think in terms of present types of personnel, positions, equipment, etc. Temporarily, he should eliminate from his vocabulary such terms as classroom, laboratory, desk, textbook, library, counselor, and even teacher. Because of the restricting associations these terms have, they limit the designer's ability to revise his thinking. On the other hand, when the model is ready for documentation, a description must be prepared for materials, equipment, facilities, and personnel. At this stage new organizing concepts must be developed and terms applied to them. For example, in a new system, the term "teacher" may describe a position in which the person performs a great many different activities, some of them almost unrelated in content, action, or objective to the traditional notion of teacher. Although some former terms will

still be applicable, new terms to describe activities, materiel, and positions may have to be developed. This work of organizing and naming must precede the actual detailing of requirements for personnel and materiel.

7. The next step is to test the requirements of the ideal system against reality--both as to availability of personnel and materiel, and as to feasibility of implementing the system.

   By availability of materiel and personnel we imply only the question of existence, or possible existence in the near future, of specified materiel and personnel. Thus, a system that requires a real-time computer, with a core memory far in excess of those currently in production, would be unavailable.

   By feasibility of implementing the system we imply such questions as cost and acceptability of the system to the community.

8. The reality test described as step seven provides the basis for another decision--whether the system is ready for implementation. This decision is a matter of judgment. If only minor system modifications are required to make implementation a reasonable next step, the system analyst should certainly make these adjustments and proceed to implementation; however, if major changes are necessary, he should make these changes, as in step five, and then move back through steps three, four, five, six, seven, and eight.

9. If the system proves to be ready for implementation, it should first be tested in the field. This implies a close working relationship with patrons, school personnel, state officials and teacher-training institutions. No markedly different system can be implemented without the full cooperation of all of these groups. Those persons responsible for implementation should be willing, but not over-anxious, to modify the system as necessary to adjust to problems not anticipated prior to live testing.

The nine steps suggested for analyzing and designing systems for schools are not intended to follow one another in perfect sequence. For example, goals can never be fully described until a great deal of work has been done on construction of the model, or conversely, a very exact statement of system goals predetermines much of the model.

Despite this and other limitations, we believe that the paradigm described can be of real value as a guide to the educator who aspires to take a fresh look at his school.

SUMMARY

Despite the technological and methodological advances that are being developed in education, school practices remain relatively unchanged. One apparent reason for this failure to make effective use of innovations is that traditional schools are not so designed as to adapt readily to changes. This paper suggests an approach to analysis and design of school systems that will accommodate change more easily.

As a point of departure in the paper, three schools experimenting with innovations are described and problems inherent in their experimentation are mentioned. These problems are then projected into some general objectives of school system analysis and design.

The major portion of the paper is a paradigm consisting of nine steps recommended in the analysis and design of school systems.
1. Prepare a statement of educational goals.
2. Develop a descriptive model of the system.
3. Simulate model on computer.
4. Determine whether the model is ready for documentation.
5. If the model is not ready for documentation, make appropriate changes.
6. When simulation proves it satisfactory, document the model.
7. Test the system requirements against reality.
8. Determine whether the system is ready for implementation.
9. When the system is ready for implementation, conduct field tests.

APPENDIX A

START

IS SCHOOL POLICY AGAINST DIRECT REFERRAL ? —YES→ MAKE RECOMMENDATION TO PARENTS AND STUDENTS → FOLLOW-UP ACTION THROUGH STUDENT → END

CHECK LIST OF EXTERNAL AGENCIES

DO ANY AGENCIES SEEM APPROPRIATE ? —YES→ CHECK SOURCES OF INFORMATION ABOUT ADEQUACY OF AGENCIES → IS INFORMATION SUFFICIENT ? —YES→ ARE AGENCIES ADEQUATE ? —YES→

ARE THERE MORE DISTANT AGENCIES APPROPRIATE ? —YES→ CHECK SOURCES OF INFORMATION ABOUT ADEQUACY OF DISTANT AGENCIES ? → IS INFORMATION SUFFICIENT ? —YES→ ARE AGENCIES ADEQUATE ? —YES→

RECORD CONDITION OF NEED. INFORM STUDENT AND PARENTS

FOLLOW-UP • AT LATER TIME

END

DOES STUDENT WANT HELP ? —NO→ TRY TO CHANGE ATTITUDE OF STUDENT → IS ATTITUDE CHANGED ? —NO→ IS SCHOOL REQUIRED TO MAKE REFERRAL ? —NO→ FOLLOW-UP AT LATER TIME → END

WILL STUDENT LOSE SCHOOL TIME ? —YES→ MAKE ARRANGEMENTS → WILL PARENTS RESENT ACTION ? —YES→ SEEK PARENT COOPERATION → WILL PEERS REJECT STUDENT ? —YES→ SEEK PEER UNDERSTANDING
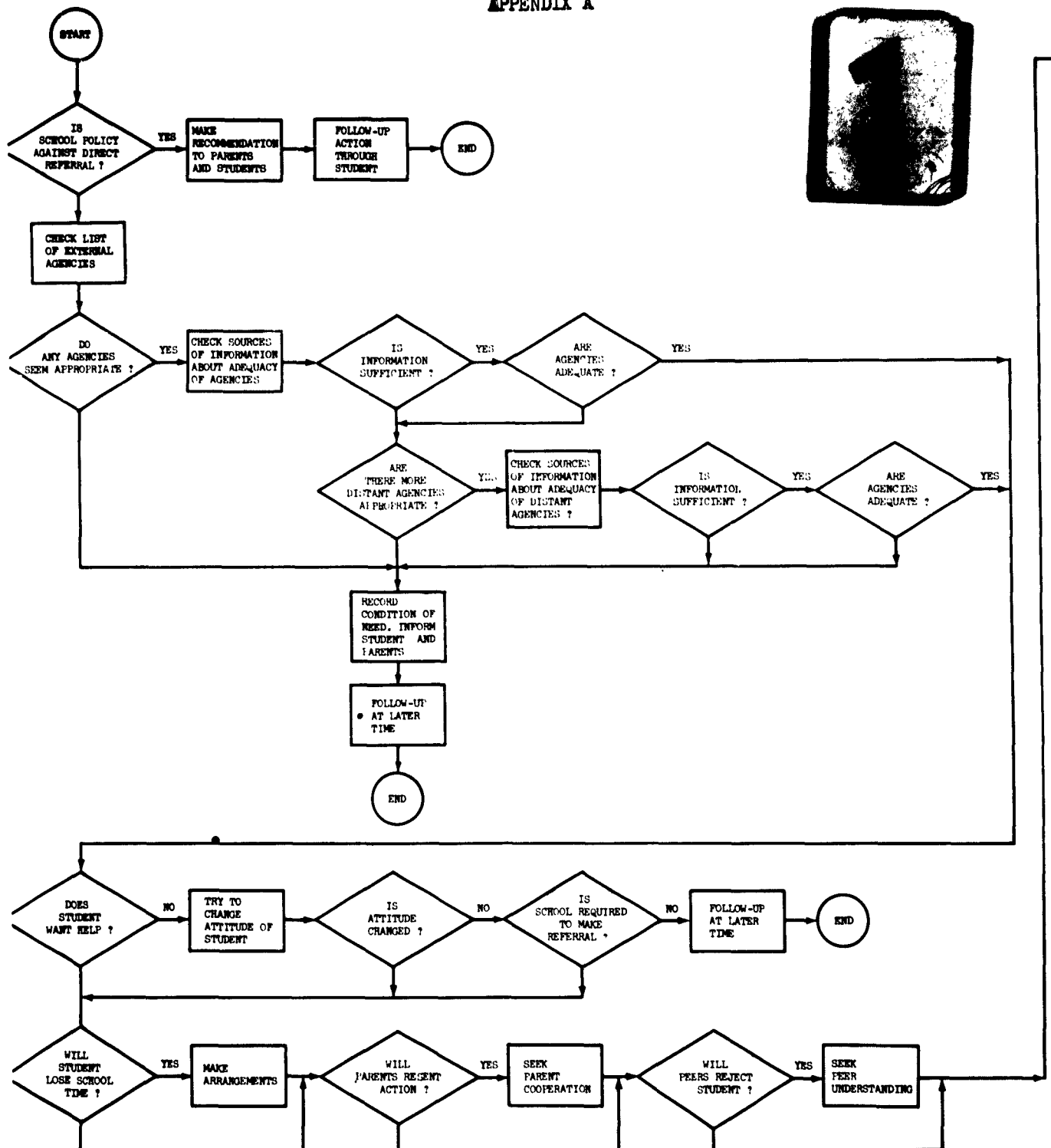
FIGURE 3. COUNSELING REFERRAL SUBROUTINE
(Flow diagram prepared by J. F. Cogswell,
of a school district in Southern Californ

IS REFERRAL TO SUPPLEMENT COUNSELING ? — YES → CONTACT AGENCY AND WORK OUT COOPERATIVE PLAN → WILL AGENCY COOPERATE ? — NO → COULD STUDENT BE EN'FED IN AGENCY ? — NO → CONTINUE TO WORK WITH STUDENT → END

WILL AGENCY COOPERATE ? — YES

COULD STUDENT BE EN'FED IN AGENCY ? — YES → PLAN TO FOLLOW-UP THROUGH STUDENT?

SHOULD PARENTS BE CONTACTED ? — YES → WILL AGENCY MAKE CONTACT — NO → CONTACT PARENTS → SHOULD SCHOOL ADMINISTRATORS BE CONTACTED ? — YES → WILL AGENCY MAKE CONTACT ? — NO → CONTACT SCHOOL ADMINISTRATOR

WILL AGENCY MAKE CONTACT → ADVISE AGENCY TO CONTACT PARENTS

WILL AGENCY MAKE CONTACT ? → ADVISE AGENCY TO CONTACT SCHOOL ADMINISTRATORS

ARE AGENCIES ADEQUATE ? — YES

SHOULD TEACHERS(S) BE CONTACTED ? — YES → WILL AGENCY MAKE CONTACT — NO → CONTACT TEACHER(S) → IS FINAL ADMINISTRATIVE APPROVAL NEEDED ? — YES → GET APPROVAL

WILL AGENCY MAKE CONTACT → ADVISE AGENCY TO CONTACT TEACHER(S)

GET STUDENT APPROVAL FOR TRANSMISSION OF CONFIDENTIAL INFORMATION → MAKE FINAL REFERRAL ARRANGEMENTS → END

END

SEEK PEER UNDERSTANDING

LING REFERRAL SUBROUTINE - INTERACTION WITH EXTERNAL AGENCIES
ared by J. F. Cogswell, based on actual counseling procedures
rict in Southern California.)

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1 flow chart

Unclassified report

DESCRIPTORS: Education.

Suggests an approach to analysis and
design of school systems that will

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accomodate change and adaptation
in school practices. Describes
three schools experimenting with
innovations and discusses the
problems inherent in their experimentation.
Projects these problems into some general
objectives of school system analysis and
design. Recommends nine steps in this
analysis and design.